Contribution ID: **36** Type: **not specified**

Investigation of the activated areas in various synchrotron radiation facilities

Monday, 23 September 2019 15:53 (33 minutes)

We are working on the research for establishment of more reasonable decommissioning process of accelerator facilities with the aid of Japan Nuclear Regulation Authority. In this research, there are three important issues: (1) clarification of the target facilities and accelerators for assessment of activation, (2) development of novel technique for assessment of activation, and (3) provide a guideline for decommissioning as a manual book. This research has been progressed since September 2017. To achieve the aim of theme (1) and (2), we have investigated various type of facilities such as synchrotron, cyclotrons, and electrostatic accelerators. In this presentation, we will discuss the result of radiation measurement experiment at some typical synchrotron radiation facilities in Japan. The investigated facilities and maximum acceleration energy are follows: Spring-8 (8 GeV), KEK PF (2.5 GeV), UVSOR (750 MeV), HiSOR (700 MeV), and SR-center (575 MeV). These accelerators not only differ in the maximum energy but also differ in the type of pre-accelerator up to the storage ring. First, we set the solid track detectors (CR-39) and the thermo-luminescent dosimeters (TLD) at principal places that were expected the beam-loss level was high, and mapped the thermal and epithermal neutron flux for the whole facility. And, after the accelerator operation was stopped, contact dose-rate measurement with a NaI survey meter and gamma-ray spectrometry with a LaBr3 scintillation detector was conducted for the beam line components such as magnets, beam profile-monitors, gate-valves and beam-pipes. In all facilities, activation level was quite low. Whole beam-line tunnels made of concrete were not activated and no radionuclides were detected except natural nuclides. Also, almost beam-line components were not and/or low activated. Especially, no places exceeded the background level with dose-rate measurement in SR-center. Whereas, some components such as RF-cavity, beam-profile monitor, and flexible tube joint were strongly activated, and nuclides made by (γ, n) reaction such as 51Cr, 54Mn, and 57Ni were identified. 57Co which is a daughter nuclide of 57Ni was also detected in the same place. 57Ni could be considered to reflect the beam-loss during the just previous operation, due to short life of 36 h. Actually, we found the count rate (cps) of 57Ni and the contact dose rate of an accelerator component showed good correlation in all facilities. This result indicates the beam losses in the synchrotron radiation facilities could be normalized regardless of the acceleration energy. Details and other results will be discussed in the presentation.

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Session Classification: Session 3